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(54) Digitizers.

(57) A digitizer of high resolution and capable of discerning a pattern of applied low differential pressure is described. The digitizer comprises a matrix of cells each having a switch means, including a resistive means, and means for determining the pattern of a plurality of simultaneously applied pressures.

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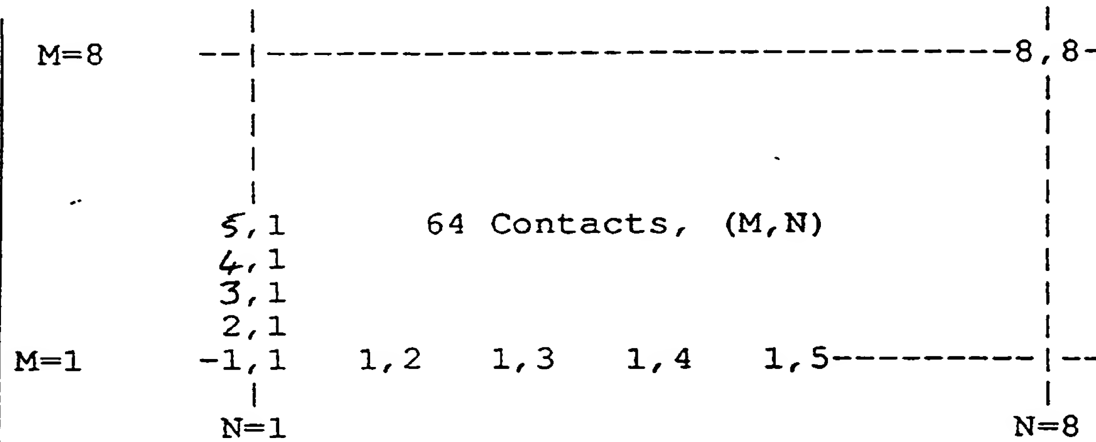

Fig. 1a

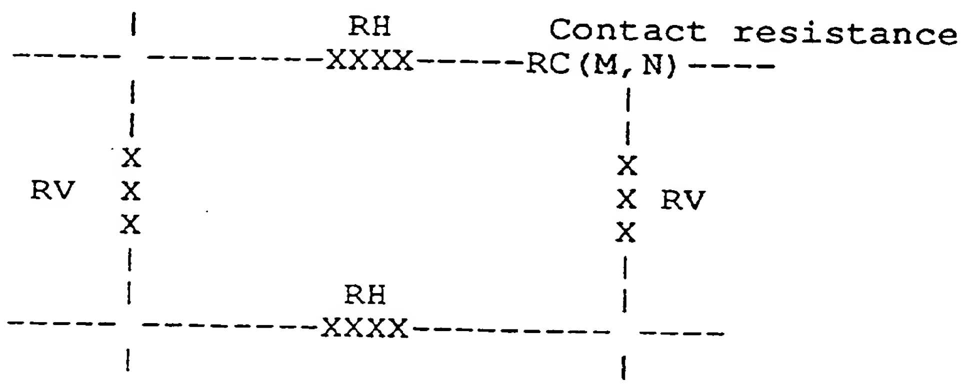

Fig 1b

REPORT No.

APPROVED	TITLE Unit cell outline.	No Figure 1	SH. No.

This invention concerns digitizers of the kind comprising a matrix of sensitive areas or cells each responsive to an applied stimulus to provide an output indicative of the position within the matrix at which the stimulus was applied.

A well known form of digitizers is that used in computer related graphics. This digitizer comprises a pad having a "drawing" area formed of a matrix of pressure sensitive cells responsive to the applied pressure of a stylus point drawn across the surface of the pad. The digitizer is used for inputting freehand drawing, manuscript or like graphics materials to a computer. The matrix may be formed of a plurality of parallel first conductors with orthogonally extending second conductors arranged to make contact with the first conductors on the application of pressure to a support for the second conductors. One method of determining the absolute x, y coordinates of the point of applied pressure is to apply a potential to each first conductor in turn whilst measuring the presence or absence of a potential on each of the second conductors. This "scanning" of the conductors takes a finite time and, in consequence, there is usually a maximum speed at which the stylus can be moved across the pad for faithful corresponding reproduction on the screen of a display unit of the computer. Further, such a digitizer cannot cope with simultaneously applied pressure at a plurality of points on the pad. It merely "sees" them, if at all, as a plurality of sequentially applied pressures (due to the finite scan) and may attempt to connect the points as in a drawing.

Further, in a known digitizer of this kind (sometimes called a "graphics tablet"), the applied pressure from the stylus point is relatively high.

Other digitizers are known which can utilise light responsive or electrostatic or electrodynamic responsive means to identify the location correspondingly so stimulated.

Fingerprints provide a near-infallible method of distinguishing between individuals. The degree of certainty depends upon the level of sophistication of comparison techniques that are used. For the purpose of indentity confirmation in connection with credit card usage, point-of-sale detecting systems and many other applications, comparison of a relatively small number of points will suffice. For more rigorous applications, a greater number of points must be considered.

The epidermal ridges which form the loops, arches whorls of fingerprints are less than 0.5 mm in width, the spacing of such ridges being of the same order. Despite the fact that some present day digitizers claim a resolution of this order, their pressur differential sensitivity would not enable them to be used for fingerprint verification in addition to th ir inability to distinguish between simultaneously applied plural pressure points.

The present invention has for its object, the provision of a pressure sensitive digitizer able to sense, at high resolution, low differential pressures simultaneously applied at a plurality of points to the digitizer, for example, in identifying or verifying fingerprints.

According to the present invention, there is provided a digitizer comprising a matrix of pressure sensitive cells on an undeformable support, the matrix being defined by a plurality of parallel first conductors and a plurality of parallel second conductors overlying said first conductors, and defining therewith a cross-over point for each cell, switch means associated with each cross-over point, resistive means in each of the switch means, and an overlying resiliently deformable film providing, for each cell, a contact bridge for operating the switch means in response to an applied pressure.

Each resistive means may comprise a thin film resistor connected by one end to one of the first conductors and by a second end thereof to a respective metal pad.

An insulating layer preferably overlies the first conductor and the thin film resistors, the insulating layer having a respective first via in register with each of the pads.

The insulating layer may support the second conductors on its surface and, for each cell of the matrix, a metal contact which extends through the first via into electrical contact with the respective metal pad.

Insulative spacing means on the insulating lay r may define, for each cell, a well wherein the metal contact and an adjacent portion of a second conductor are exposed.

The metal contact and the adjacent portion of the second conductor may be of interdigitated form.

In one embodiment, the contact bridges of the resiliently deformable film are supported, each over a respective well, by the insulative spacing means, the film and the contact bridges being sufficiently flexible to permit deformation into each of the wells to bridg between the respective contact and adjacent second conductor.

In a preferred embodiment, the contact bridges are of size such as to be able to bridge between metal contacts and interdigitated adjacent portions of second conductors but of insufficient size to bridge between metal contacts of first cells and second conductors of adjacent cells.

The film is preferably of MYLAR (Trademark) of thickness approximately 3 μm.

Conveniently, each cell, defined by the orthogonal conductors is of side length of the order of 100 μm. The cell density may be such that som 10000 cells are provided per square centimetre.

The digitizer may be fabricated by micro photolithographic techniques used in the manufacture of integrated circuits. Thus, upon a relatively undeformable support, the first conductors and metal pads may

be deposited by masking and vacuum deposition or plating and/or by plating or vacuum deposition and, thereafter, masking and etching as necessary. The resistors, for xample, Nichrome high stability, low temperature coefficient, resistors are similarly deposited so as to connect each metal pad to its adjacent first conductor. A polyimide or similar insulative material may then be grown or deposited over the first conductors and metal pads with a respective first via being provided to the metal pad. A second metal layer is similarly deposited on the insulative material layer so as to provide the second conductors and, for each cell, a contact pad electrically integral with the respective second conductor and, spaced and electrically isolated therefrom, a contact pad extending through the first via into electrical contact with the metal pad.

A further polyimide or similar insulative material layer may then grown or deposited thereover with, for each cell, a second via exposing at least a part of each of the contact pads of the cell. The via sidewalls may define a well for each cell.

A surface layer, preferably of a material such as Mylar, (Trademark), having a thickness which may be of the order of 3 μm and bearing on its confronting surface, in a first embodiment, for each cell, a respective contact bridge, may then be located thereover with each contact bridge in register with a respective one of the wells.

In a second embodiment, the surface layer has a pattern of contact bridges each of size sufficient to bridge between a metal contact and its adjacent portion of a second conductor but of insufficient size to bridge between a metal contact and a second conductor of an adjacent cell. The pattern has a high density of such contact bridges and may overlay the cells without any requirement for registration.

The surface layer has the properties of resilient deformability and is very flexible so as to be able to conform, upon the application of low differential pressures to high resolution features such as the patterns of a fingerprint.

The invention will be described further, by way of example, with reference to the accompanying drawings in which:-

Figs. 1a and 1b are diagrammatic representations a digitizer having a matrix of 64 cells, and of an individual cell;

Fig. 2 is a diagrammatic computer representation of a switch closure pattern with theoretically optimum parameters;

Figs. 3 to 6 are similar representations with more practical paramet rs applied;

Fig. 7 is a view, similar to Fig. 2 of a different switch closure pattern;

Figs. 8, 9 and 10 are representations, similar to Fig. 7, to which more practical parameters have been applied;

Fig. 11 is a table illustrating practical results obtainable using a hard-wired breadboard 4 x 4 matrix;

Fig. 12 is a table, similar to that of Fig. 11, listing results obtained using a hard-wired breadboard 8 x 8 matrix;

Figs. 13a and 13b are circuit diagrams of alternative sensors usable with the digitizer of the present invention;

Figs. 14 and 15 are diagrammatic representations of a single cell of a digitizer according to a first embodiment of the present invention; and

Figs. 16, 17 and 18 are diagrammatic representations of preferred contact arrangements of cells of a digitizer according to the present invention.

Referring firstly to Figs. 1 to 10, various computer models were set up and examined to determine the feasibility of detecting fingerprint patterns. Fig. 1 shows, diagrammatically a matrix defined by 8 rows M and 8 columns N of conductors. A total of 64 crossover points therefore exist. For each cell (Fig. 1b), a row resistance RH, a column resistance RV and a contact resistance RC exist when a contact is made.

In the matrix of Fig. 1a, if all the contacts are closed, the contact M_1, N_1, provides a total resistance of RV + RH + RC ohms. The contacts M_8, N_8, provides a total resistance of 9RV + 9RH + RC ohms. This is on the assumption that all the column electrodes are grounded at their lower ends and a voltage is applied to the left end of each row electrode. A possible total of 57 loops and, therefore, 57 relationships exists. These 57 linear equations may be solved by matrix inversion if the e.m.f. around each loop is equated to zero or unity.

Open contacts (infinite resistance) cannot be managed by the computer. A finite value of 100M ohms is assigned to the contact resistors of any open contact. Outputs from the computer form the illustrations of Figs. 2 to 10. In these illustrations, the current due to contact closure is represented by the side length of the square depicting that contact. Further, the representations have been normalised in that each maximum current square in the various figures is of equal sidelength.

Fig.2 illustrates a first "sensed" pattern in which neither column nor row electrodes have any resistance value. The open contacts of the matrix are denoted as dots. Fig. 2 is purely theoretical in that the row and column electrodes have (certainly in microcircuitry) finite resistances. Fig. 3 is illustrative of th computer output when resistance values of 2 ohms are given to the electrodes/unit cell size. Figs. 4 and 5 illustrat the results when RH and RV are increased to 7 ohms and 10 ohms respectively. In each case, the pattern in distinguishable. Only when the values of RH and RV approach that of RC (as shown in Fig. 6) is the pattern not correctly discernable.

Fig. 7 illustrates a different pattern modelled by the computer on a 20 x 20 matrix with zero resistance

of the column and row electrodes. As shown by Figs. 8, 9 and 10, the pattern is still discernable when the more practical values of 5,5; 1,10; up to 10,10 ohms are fed into the computer as values for RH and RV respectively.

Fig. 11 shows actual measured values when a breadboarded 4 x 4 matrix had contacts of 100 ohms resistance closed as shown in the respective pattern diagram. Discernability of pattern is still possible with floating column electrodes even when all but one of the contacts are closed. If the column electrodes are grounded, the discernment is complete but this is due to the zero (or near zero) resistance of the breadboarded electrodes. In this instance, RC was 100 ohms and a 2.5 V row voltage was used.

Fig. 12 is similar to Fig. 11 in showing actual measured values on an 8 x 8 breadboarded matrix. In this case finite values (100 ohms) were given to RV and RH and the contact resistance RC was through a 10K resistor. The pattern is shown. The column electrodes were grounded.

From the computer modelling and from the breadboard results, it is clear that greatest discernability exists if the contact closure resistance is made high relative to the electrode resistance. Preferably RC> 10 x RV and 10 x RH. Further, the electrode resistance will limit the matrix size as it is inversely proportional thereto. The electrode resistance will also be inversely proportional to the maximum closure density.

The row electrode may be driven by a set of voltages having a binary relationship. Using high contact resistances and low electrode resistances, the output current values would then be directly indicative of the closure pattern. Alternatively, if only one row electrode at one time is driven and the remainder are grounded, parasite row electrode potentials would be reduced and resistance limitations would then be eased. The hardware implementation of such an arrangement is also straight forward to implement.

In a digitizer according to the invention, it is necessary to provide current sensing means for each column electrode N. Such current sensing means may be formed by the circuit shown in Fig. 13a. Input from the column electrode is to the emitter of a transistor connected between a rail voltage Vcc and ground by a divider circuit including resistors R1 and R2 and the collector emitter circuit of the transistor. A constant voltage is applied to the base of the transistor and variations in the collector voltage provide an output indicative of current flow.

Alternatively, the circuit shown in Fig. 13b may be used. Here, each column is conn cted to an inverter gate of, for xample, a 4069 UBP CMOS integrated circuit. The column voltage is normally greater than V_{cc} eg $V_{cc} \geqq 3$ volts and column voltage $\leqq 6$ volts. Contact at a cell is indicated when a preset output voltage V_{DD} changes to a value $V_{cc} > V_{DD}/2 > V_{cc}/2$.

In order to provide for high resolution, the digitizer may be formed using techniques applicable in the manufacture of integrated circuits. Thus, the cells and the associated electronics could be formed on a single chip of silicon.

As shown in Figs. 14 and 15, a substantially non-deformable insulating substrate 10 which may be of plastics, glass, silicon or other suitable insulant, is masked and coated eg by plating or vacuum deposition, with metal to form a plurality of parallel row electrodes 12 spaced at, for example, 100 μm intervals. a plurality of metal pads 14 are simultaneously formed on the substrate 12 at intervals corresponding to the proposed cell density of the matrix. The width and thickness of the deposited metal electrodes 12 determines the value RV and is chosen to be as low as is practical. Thin film resistors 16 of Nichrome or a similar stable material of low temperature coefficient are deposited on the substrate 10 with one end of each resistor 16 connected to a respective pad 14 and the other end connected to an adjacent row electrode 12. The resistor pattern, determined by the desired resistance, is shown in Fig. 15.

A layer 18 of an insulant such as polyimide is deposited on top of the row electrodes 12 and the resistors 16 but first vias 20 are provide in the layer 18 over each pad 14.

A second deposition of metal is then effected on the layer 18 to provide parallel column electrodes 22, orthogonal to the row electrodes 12 and at 100 μm intervals. The metal defines not only the electrodes 22 but also contact pads 22b one for each cell, electrically integral with the column electrodes 22, and also provides electrically separate contact pads 24 which extend through the first vias 20 into electrical contact with respective pads 14. A further layer 26 of insulant defines a well or second via 28. The insulated layer 26, which is preferably polyimide, serves to space a flexible resiliently deformable film 32 from the contact pads 22b and 24.

The film 32 is of a material such as MYLAR (Trademark) and, at a thickness of 3 μm, has the necessary properties of strength and deformability. On its surface confronting the matrix, the film 32 has a plurality of bridge contacts 20, one for each cell and in register over the via 28 formed in the layer 26.

A preferred form of contact arrangements which does not require registration of the overlying sheet 32 is shown in Figs. 16, 17 and 18. As shown, in this embodiment, the column electrodes 22 provide contact pads 22c interdigitated with contact pads 24a (corresponding to the contact pads 24 of Figs. 14 and 15). The interdigitation spacing 25 is arranged to be much less than the spacing 27 between columns of cells. A film 32a (corresponding to the film 32) has a pattern of bridge contacts 22a each of maximum dimension 29 less than the spacing 27. In this way, contact may be made between interdigitated contact

pads 22c and 24a but not to adjacent columns.

Application of relatively low pressure differentials to the outer surface of the film 32 or 32a causes deformation thereof at the applied pressure areas into the wells 28 causing the respective contact bridges 22 or 22a to make electrical contact between the contact pad 22b and the contact pad 24 or between the contact pads 22c and the contact pads 24a in the well.

In a practical embodiment, a fingerprint verifier would comprise a matrix of, for example, 12.5mm square having a cell density as described above. The verifier matrix would be provided in the floor of an aperture or with a peripheral wall so as correctly to locate a fingertip relative to the matrix for sensing of the fingerprint pattern.

A ROM or like memory device may be provided with a series of look-up tables to provide a pattern output dependent upon the currents sensed. Correlation and comparison means are provided for correlating and thus comparing the sensed pattern with a pattern read from a credit card or other storage means in order to verify the fingerprint and hence the confirm or otherwise the identity of a person.

The invention is not confined to the precise details of the foregoing example and variation may be made thereto. For instance, the invention is applicable to digitizers, other than fingerprint verifiers, in which the requirement is for high resolution of low pressure differentials.

If necessary, the surface of the film 32 or 32a may be toughened using Silicon Nitride.

Other resistors than those formed of Nichrome may be used. Similar insulants other then polyimide may provide the insulating layers 18 and 26.

The suggested cell density of 10,000/cm^2 may be varied as required.

Other variations are possible within the scope of th present invention.

Claims

1. A digitizer comprising a matrix of pressure sensitive cells on an undeformable support, the matrix being defined by a plurality of parallel first conductors and a plurality of parallel second conductors overlying the first conductors, each cross-over point providing one of the cells, switch means associated with each cross-over point, resistive means in each of the switch means, and an overlying resiliently deformable film providing, for each cell, a contact bridge for operating the switch means in response to an applied pressure.

2. A digitizer as claimed in claim 1 wherein each resistive means comprises a thin film resistor connected by one end to an adjacent on of the first conductors and by a second end to a respective metal pad.

3. A digitizer as claimed in claim 2 including an insulative layer overlying the first conductors and the resistors, and having respective first vias for each metal pad.

4. A digitizer as claimed in claim 3 wherein the second conductors are supported upon the insulative layer and wherein first metal contact pads connected to the second conductors and second metal contact pads, each connected to a respective metal pad, are supported by the insulative layer.

5. A digitizer as claimed in claim 4 wherein the first metal contact pads and the second metal contact pads are interdigitated.

6. A digitizer as claimed in claim 4 or 5 wherein th contact bridges are of dimension greater than the first and second contact pad spacing but less than the intercell spacing.

7. A digitizer as claimed in claim 4, 5 or 6 including a further insulating layer covering the second conductors but having, for each cell, a respective second via in the form of a well at the bottom of which are exposed the contact pads of the cell.

8. A digitizer as claimed in claim 7 wherein the resiliently deformable film overlies the matrix with the bridge contacts thereof over the cell wells whereby deformation of the film, by the application of pressure causes one or more of the bridge contacts to electrically bridge the contact pads to operate the switch means.

9. A digitizer as claimed in any preceding claim wherein the resiliently deformable film is of MYLAR and has a thickness of the order of 3 μm.

10. A digitizer as claimed in any preceding claim wherein the matrix has a cell density of 10000 cells/cm^2.

11. A digitiser substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

12. A fingerprint verifier comprising a digitizer as claimed in any preceding claim including means for comparing a detected pattern of applied pressure with a known pattern.

13. A verifier as claimed in claim 12 including a wall peripheral to the matrix to locate a fing rtip on the matrix.

14. A method of fabricating a digitizer as claimed in any of claims 1 to 11 and substantially as hereinbefore described.

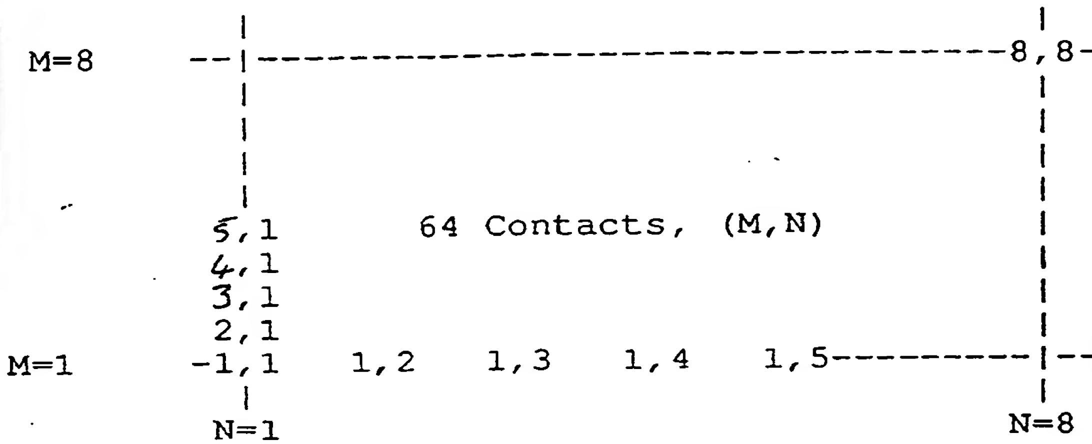

Fig. 1a

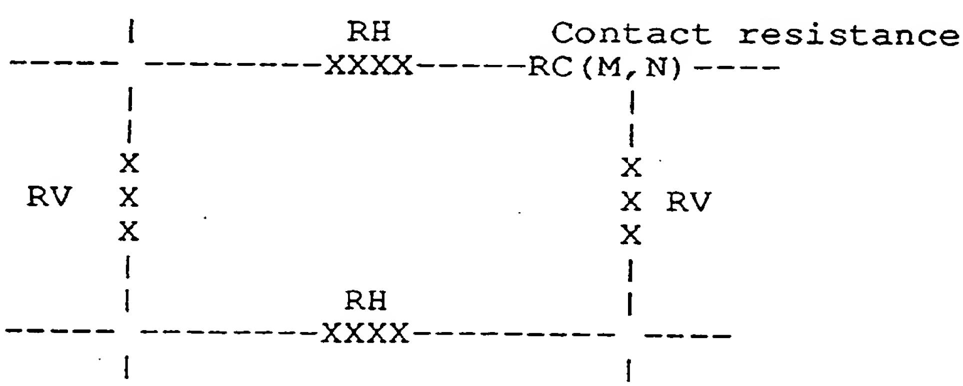

Fig 1b

REPORT No.

APPROVED	TITLE Unit cell outline.	No Figure 1	SH. No.

Form No. 303-00236FA

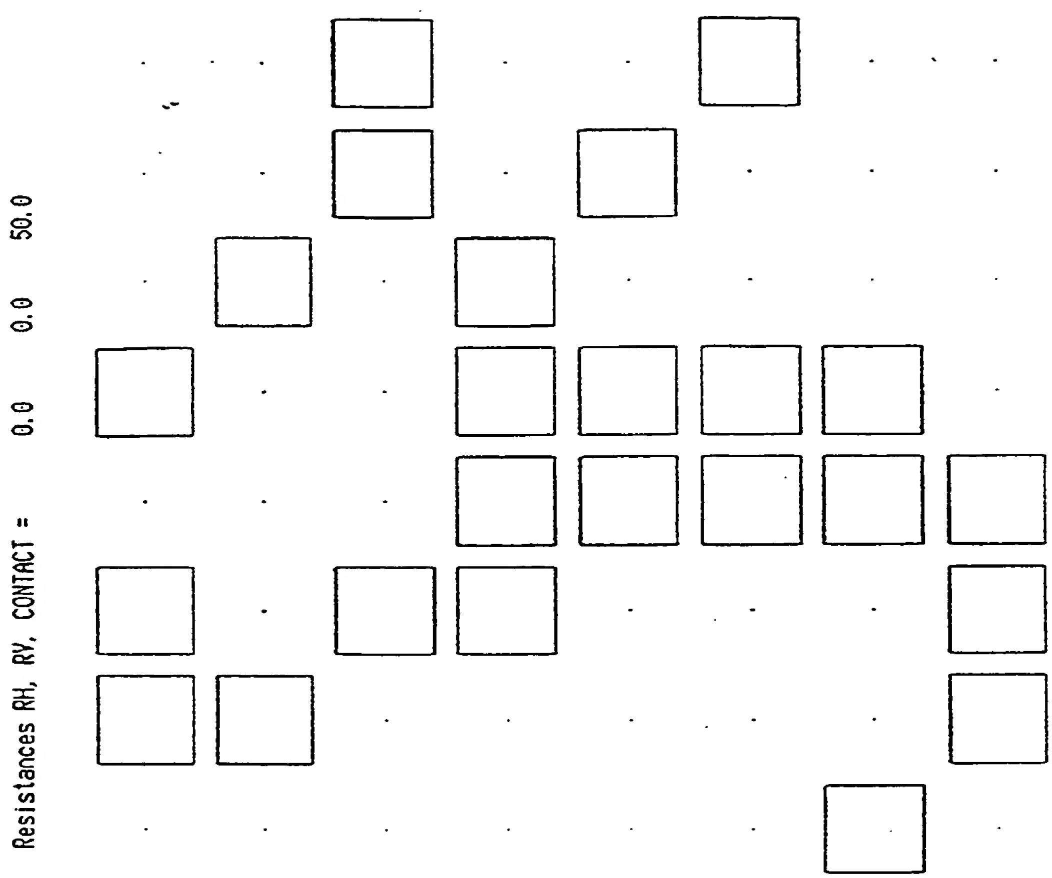

Figure 2

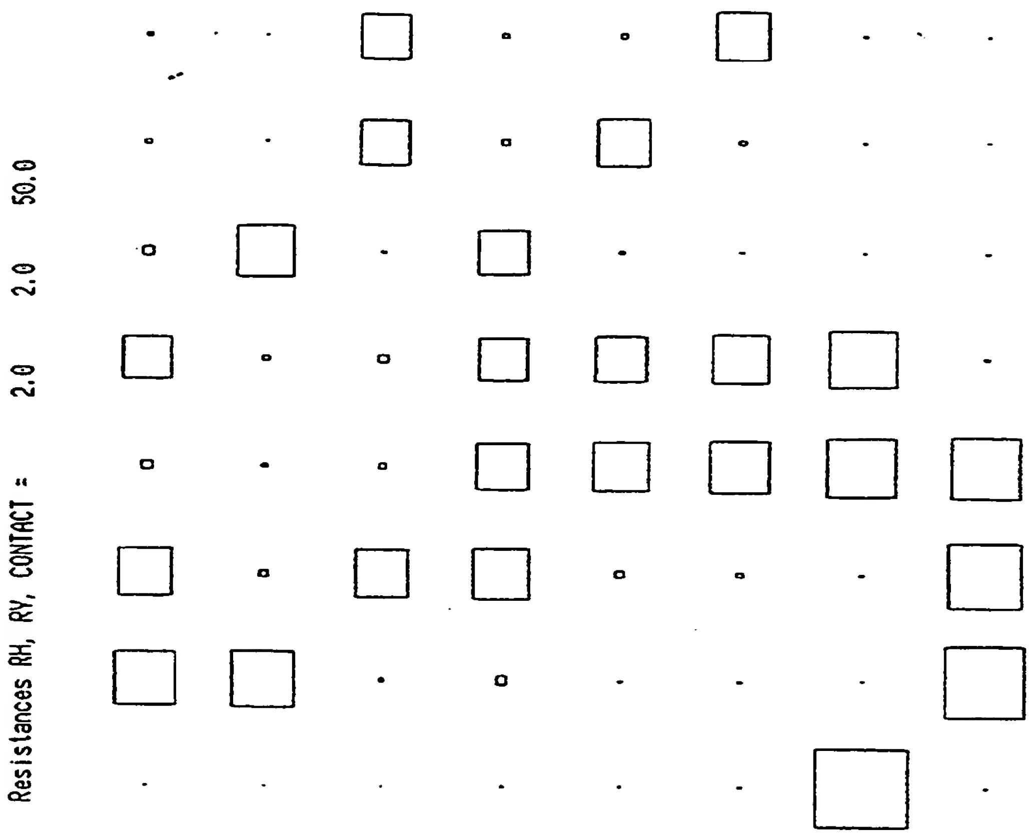

Figure ~~4~~ 3

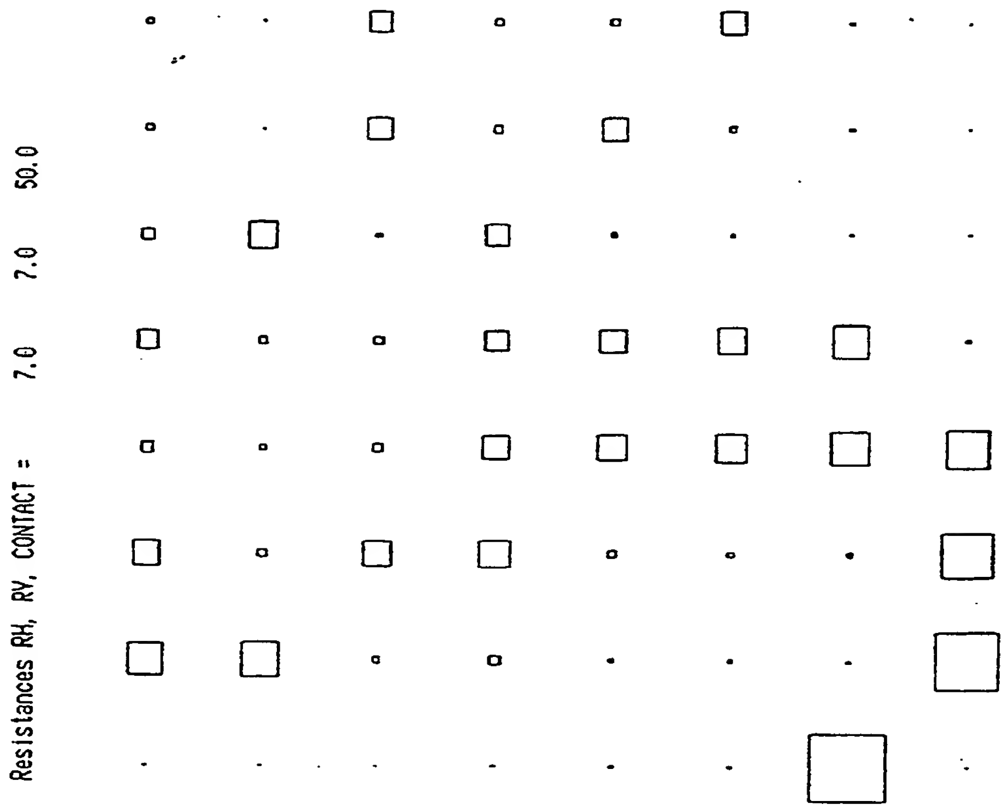

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Figure 2

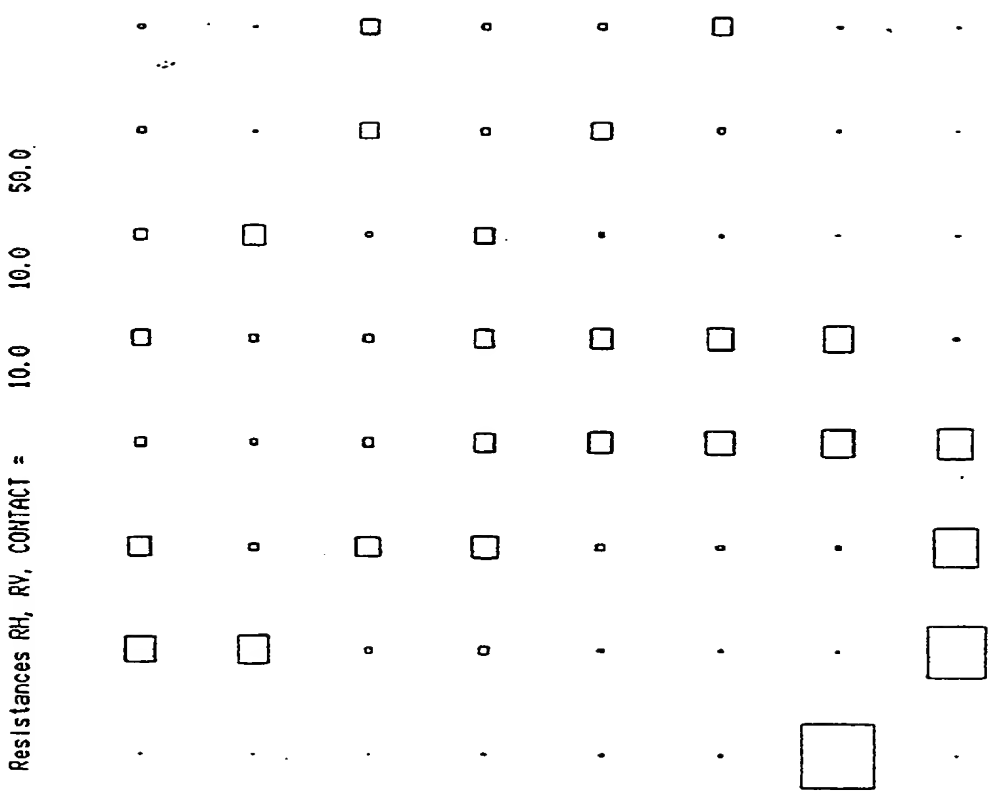

Figure ~~8~~ 5

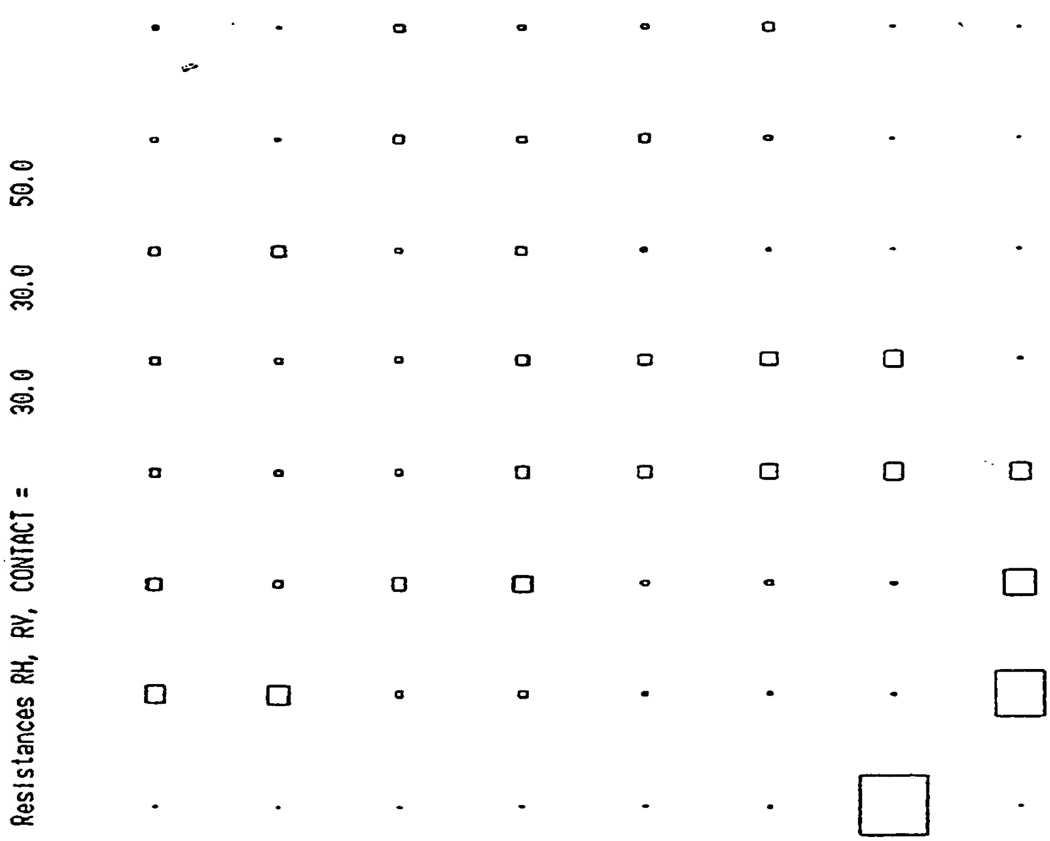

Figure ~~10~~ 6

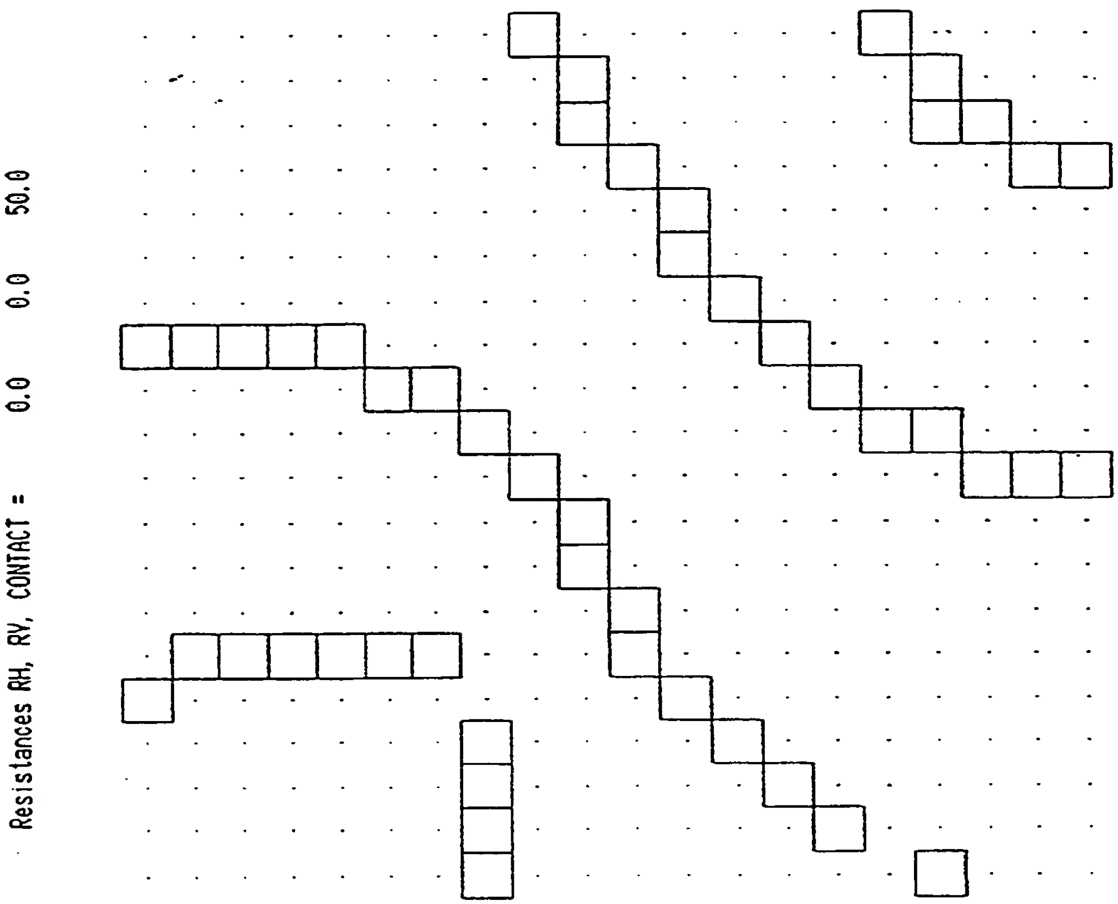

Figure ~~11~~ 7

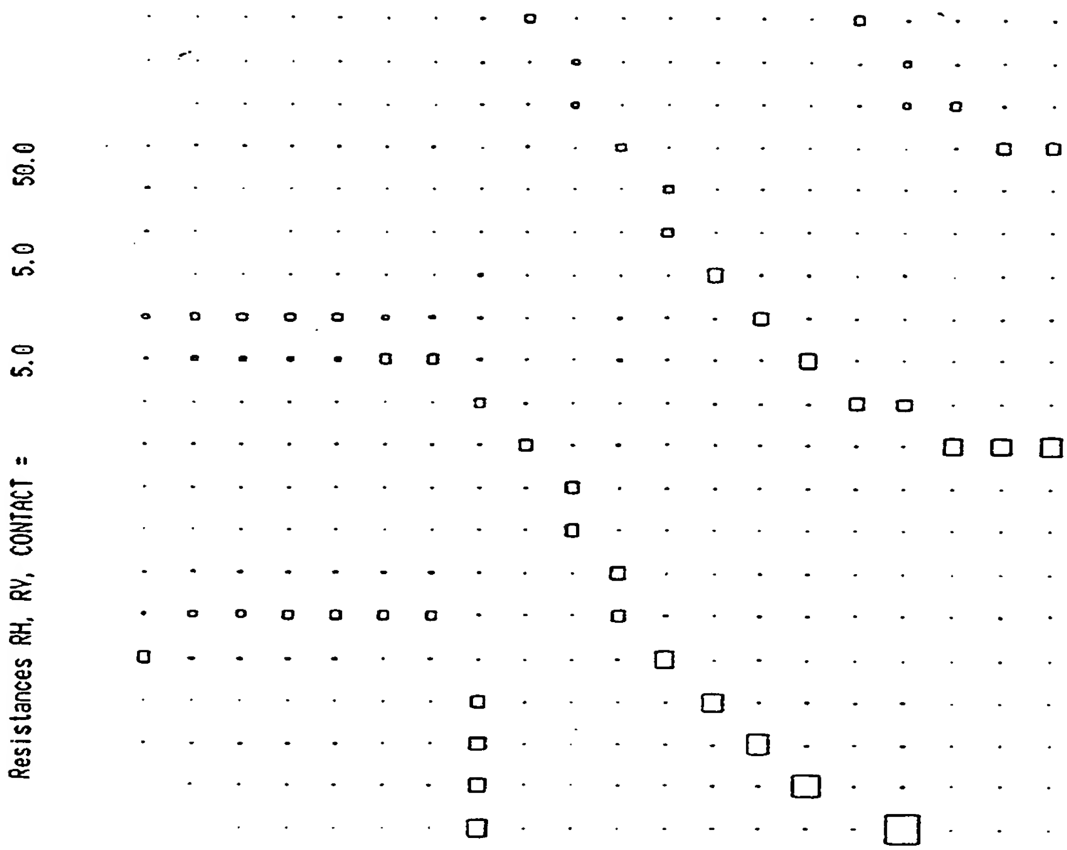

Figure ~~13~~ 8

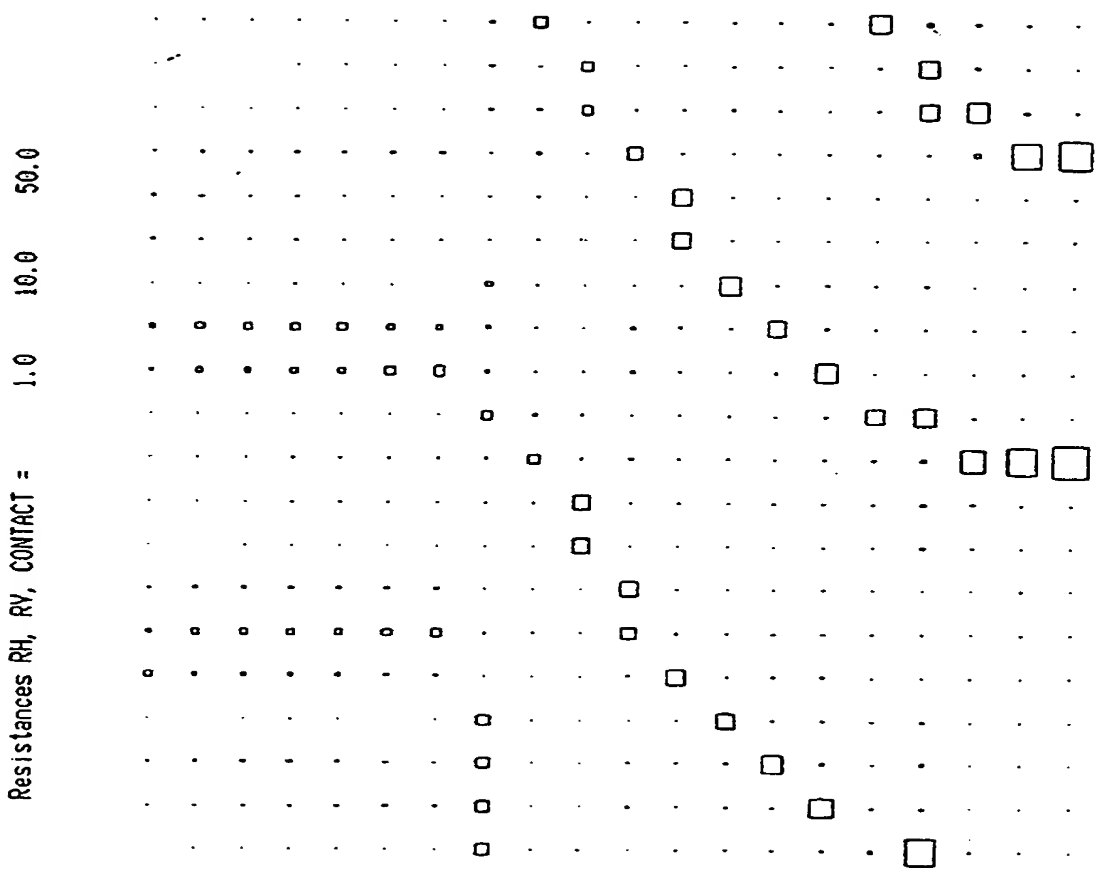

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Figure 18

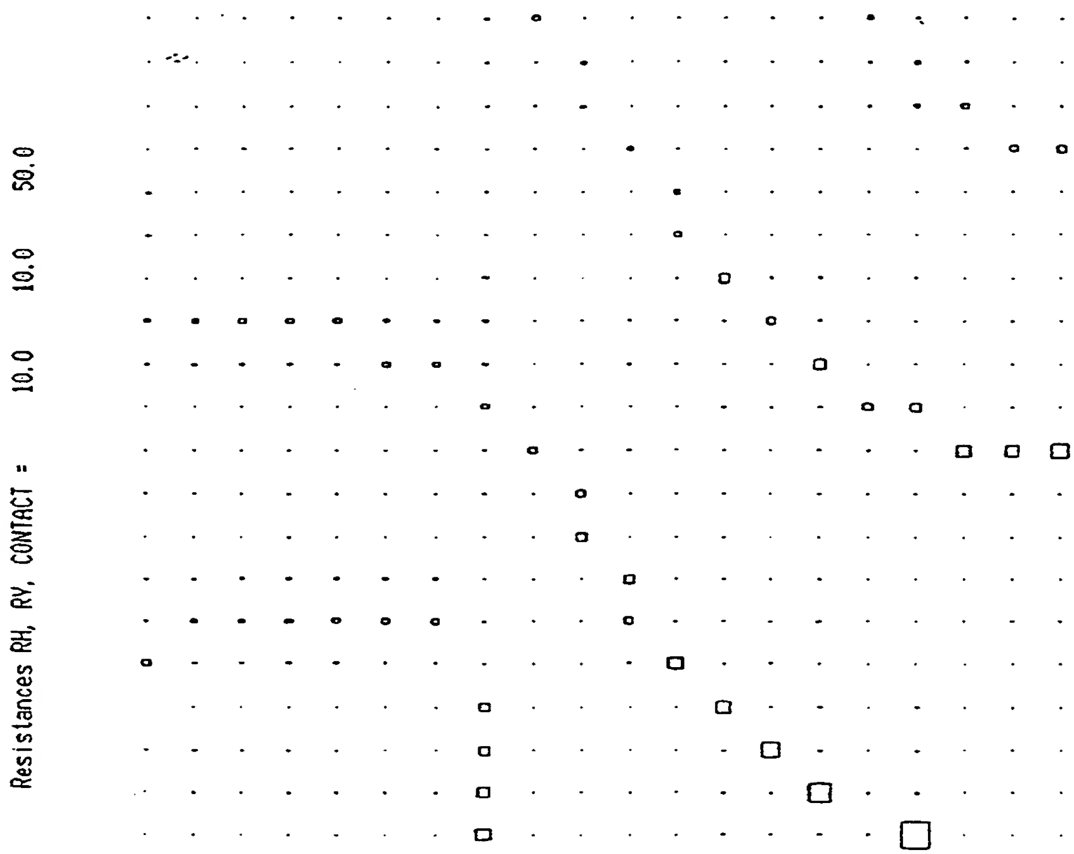

Figure ~~14~~ 10

Switch Pattern	Floating Column Electrodes	Grounded Column Electrodes
$\begin{bmatrix} * & - & - & - \\ - & * & - & - \\ - & - & * & - \\ - & - & - & * \end{bmatrix}$	$\begin{bmatrix} 25 & 0 & 0 & 0 \\ 0 & 25 & 0 & 0 \\ 0 & 0 & 25 & 0 \\ 0 & 0 & 0 & 25 \end{bmatrix}$	$\begin{bmatrix} 25 & 0 & 0 & 0 \\ 0 & 25 & 0 & 0 \\ 0 & 0 & 25 & 0 \\ 0 & 0 & 0 & 25 \end{bmatrix}$
$\begin{bmatrix} * & - & - & * \\ - & * & - & - \\ - & - & * & - \\ * & - & - & * \end{bmatrix}$	$\begin{bmatrix} 33 & 0 & 0 & 33 \\ 0 & 25 & 0 & 0 \\ 0 & 0 & 25 & 0 \\ 33 & 0 & 0 & 33 \end{bmatrix}$	$\begin{bmatrix} 25 & 0 & 0 & 25 \\ 0 & 25 & 0 & 0 \\ 0 & 0 & 25 & 0 \\ 23 & 0 & 0 & 25 \end{bmatrix}$
$\begin{bmatrix} * & * & * & * \\ - & * & * & - \\ - & * & * & - \\ * & * & * & * \end{bmatrix}$	$\begin{bmatrix} 40 & 49 & 49 & 40 \\ 20 & 40 & 40 & 20 \\ 20 & 40 & 40 & 20 \\ 40 & 49 & 49 & 40 \end{bmatrix}$	$\begin{bmatrix} 25 & 24 & 24 & 25 \\ 0 & 24 & 24 & 0 \\ 0 & 24 & 24 & 0 \\ 25 & 24 & 24 & 25 \end{bmatrix}$
$\begin{bmatrix} * & * & * & * \\ * & * & * & * \\ * & - & * & * \\ * & * & * & * \end{bmatrix}$	$\begin{bmatrix} 55 & 49 & 55 & 55 \\ 55 & 49 & 55 & 55 \\ 49 & 31 & 49 & 49 \\ 55 & 49 & 55 & 55 \end{bmatrix}$	$\begin{bmatrix} 24.2 & 24.3 & 24.2 & 24.3 \\ 24.3 & 24.4 & 24.2 & 24.3 \\ 24.2 & 0 & 24.3 & 24.2 \\ 24.1 & 24.3 & 24.5 & 24.4 \end{bmatrix}$

Figure ~~16~~ 11 Measurements taken on an 4x4 breadboarded resistive matrix with R_c = 100Ω, 2.5 V row voltage and $R_v = R_H = 0$.

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Switch Pattern	Grounded Column Electrodes
$\begin{bmatrix} * & - & - & - & - & - & - & * \\ * & - & - & - & - & - & - & * \\ - & * & - & - & - & - & * & - \\ - & - & * & - & - & * & - & - \\ - & - & - & * & * & - & - & - \\ - & - & * & - & - & * & - & - \\ - & * & - & - & - & - & * & - \\ * & - & - & - & - & - & - & * \end{bmatrix}$	$\begin{bmatrix} 22 & 0 & 0 & 0 & 0 & 0 & 0 & 21 \\ 22 & 0 & 0 & 0 & 0 & 0 & 0 & 21 \\ 0 & 22 & 0 & 0 & 0 & 0 & 21 & 0 \\ 0 & 0 & 22 & 0 & 0 & 22 & 0 & 0 \\ 0 & 0 & 0 & 22 & 22 & 0 & 0 & 0 \\ 0 & 0 & 23 & 0 & 0 & 22 & 0 & 0 \\ 0 & 23 & 0 & 0 & 0 & 0 & 22 & 0 \\ 24 & 0 & 0 & 0 & 0 & 0 & 0 & 22 \end{bmatrix}$
$\begin{bmatrix} * & * & * & * & * & * & * & * \\ * & * & * & * & * & * & * & * \\ * & * & - & * & * & - & * & * \\ * & * & * & * & * & * & * & * \\ * & * & * & - & - & * & * & * \\ * & * & * & * & * & * & * & * \\ * & * & * & * & * & * & * & * \\ * & * & * & * & * & * & * & * \end{bmatrix}$	$\begin{bmatrix} 17 & 19 & 19 & 18 & 18 & 17 & 17 & 17 \\ 17 & 20 & 19 & 18 & 18 & 18 & 17 & 17 \\ 17 & 20 & 2 & 19 & 18 & 3 & 18 & 18 \\ 17 & 20 & 20 & 19 & 18 & 17 & 17 & 17 \\ 18 & 20 & 20 & 2 & 2 & 18 & 18 & 18 \\ 17 & 21 & 20 & 19 & 18 & 18 & 17 & 17 \\ 17 & 21 & 20 & 19 & 18 & 18 & 18 & 18 \\ 17 & 20 & 20 & 19 & 19 & 18 & 18 & 18 \end{bmatrix}$

Figure ~~17~~ 12 Measurements taken on an 8x8 breadboarded resistive matrix with R_c = 10KΩ, 2.5 V row voltage and $R_v = R_H$ = 100Ω.

Fig 13a

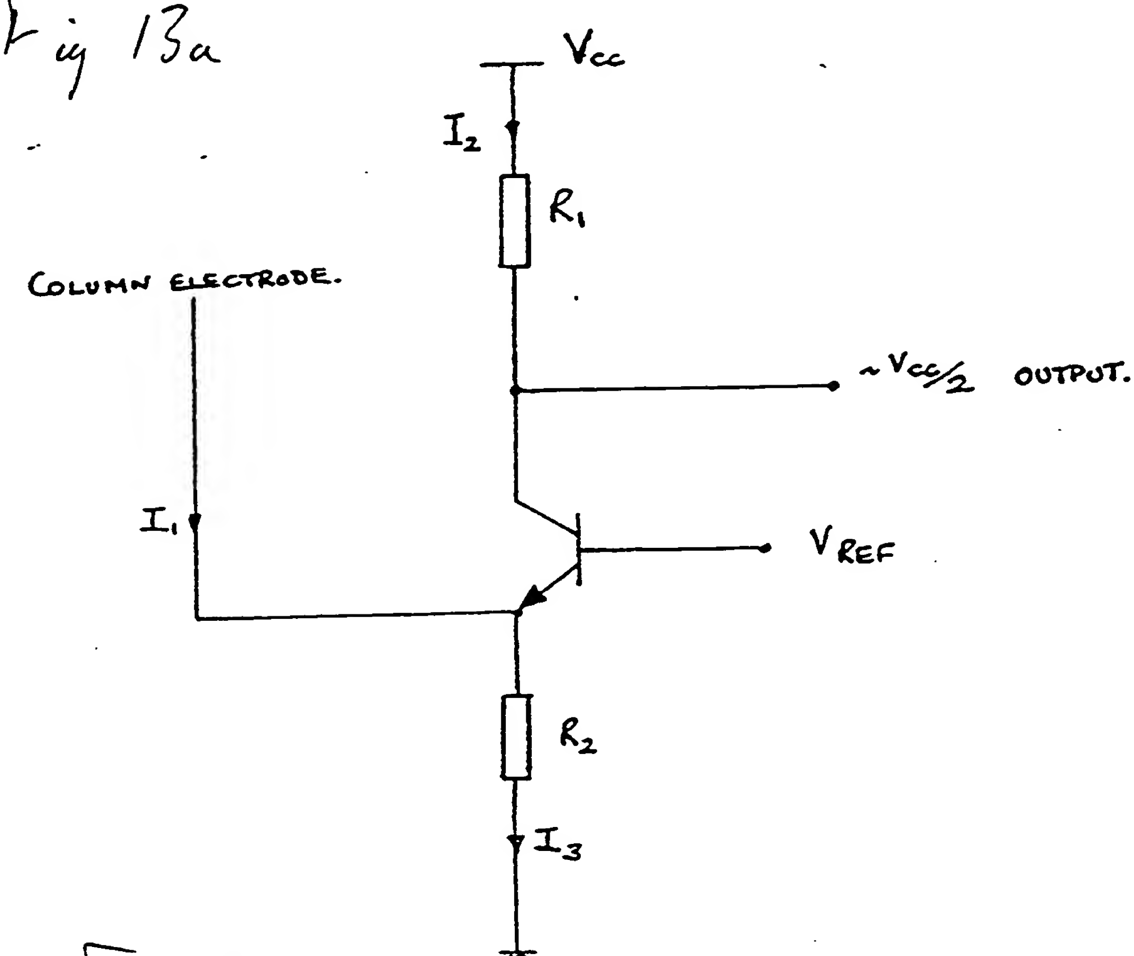


Fig. 13b

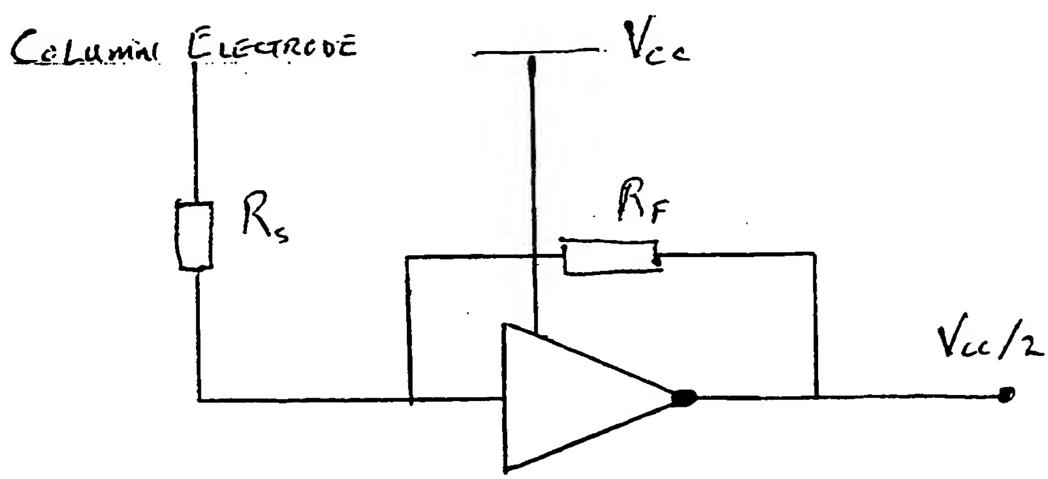
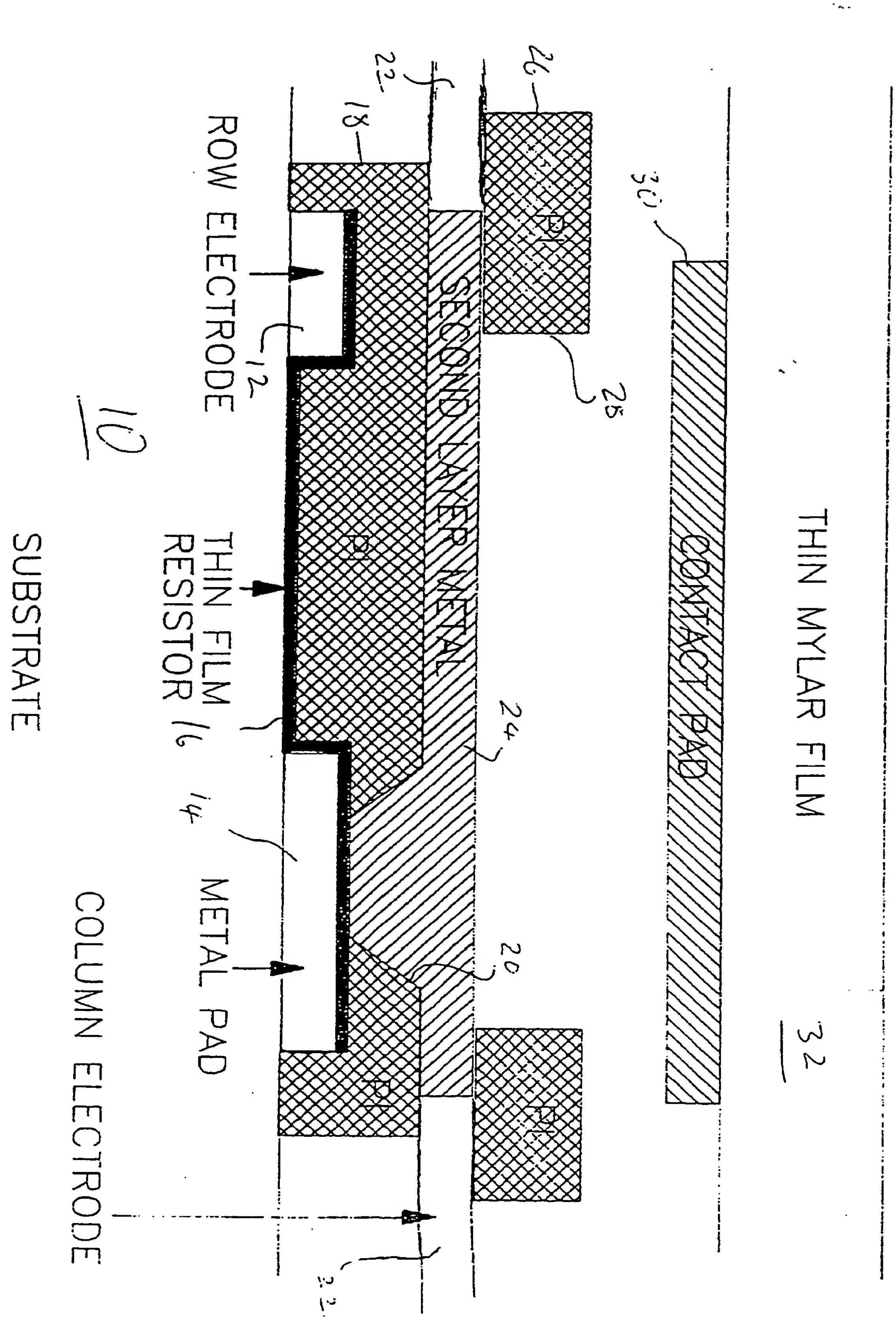


Fig. 14


THIN MYLAR FILM
CONTACT PAD
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SECOND LAYER METAL
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ROW ELECTRODE
THIN FILM RESISTOR
METAL PAD
PI
PI
SUBSTRATE
COLUMN ELECTRODE

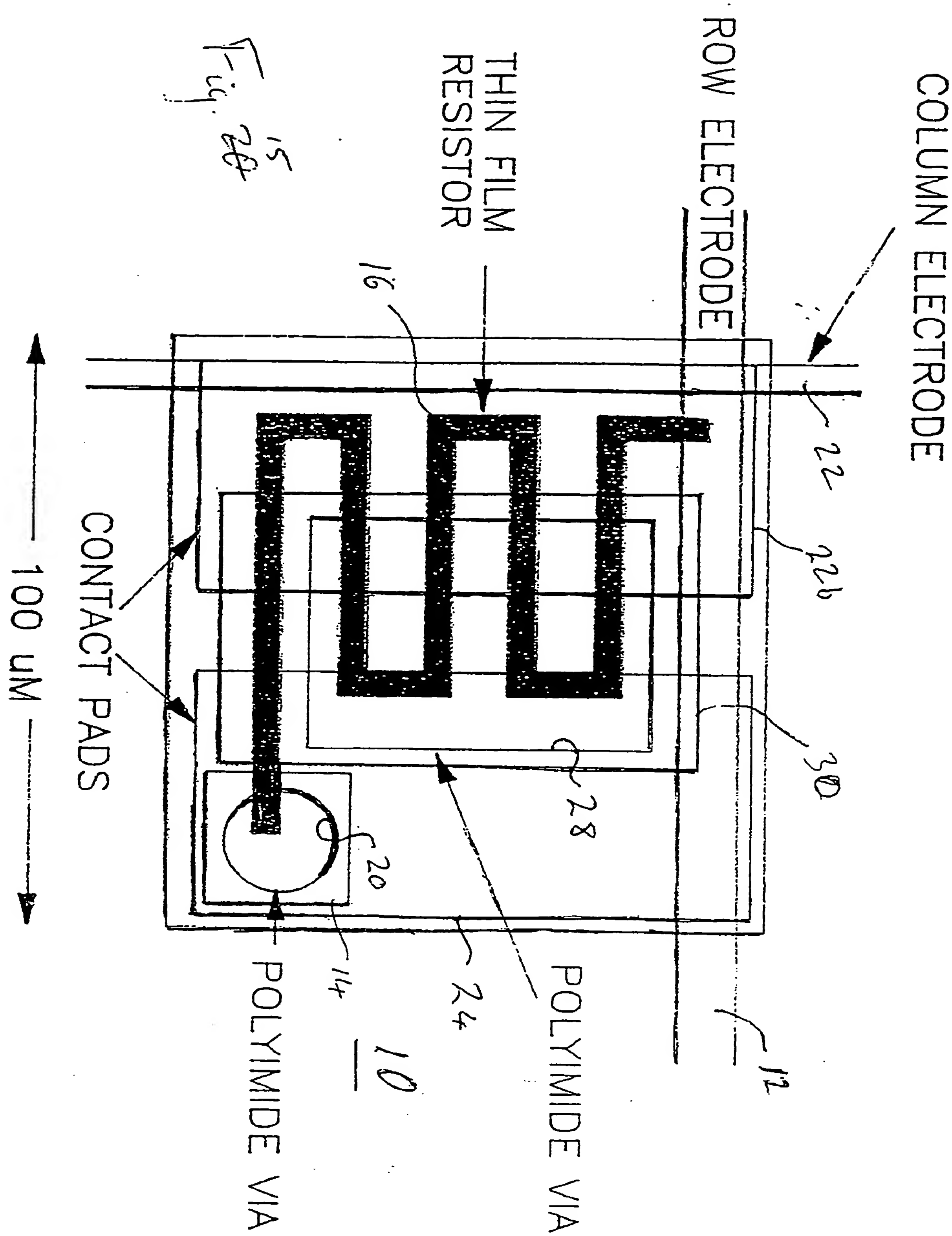
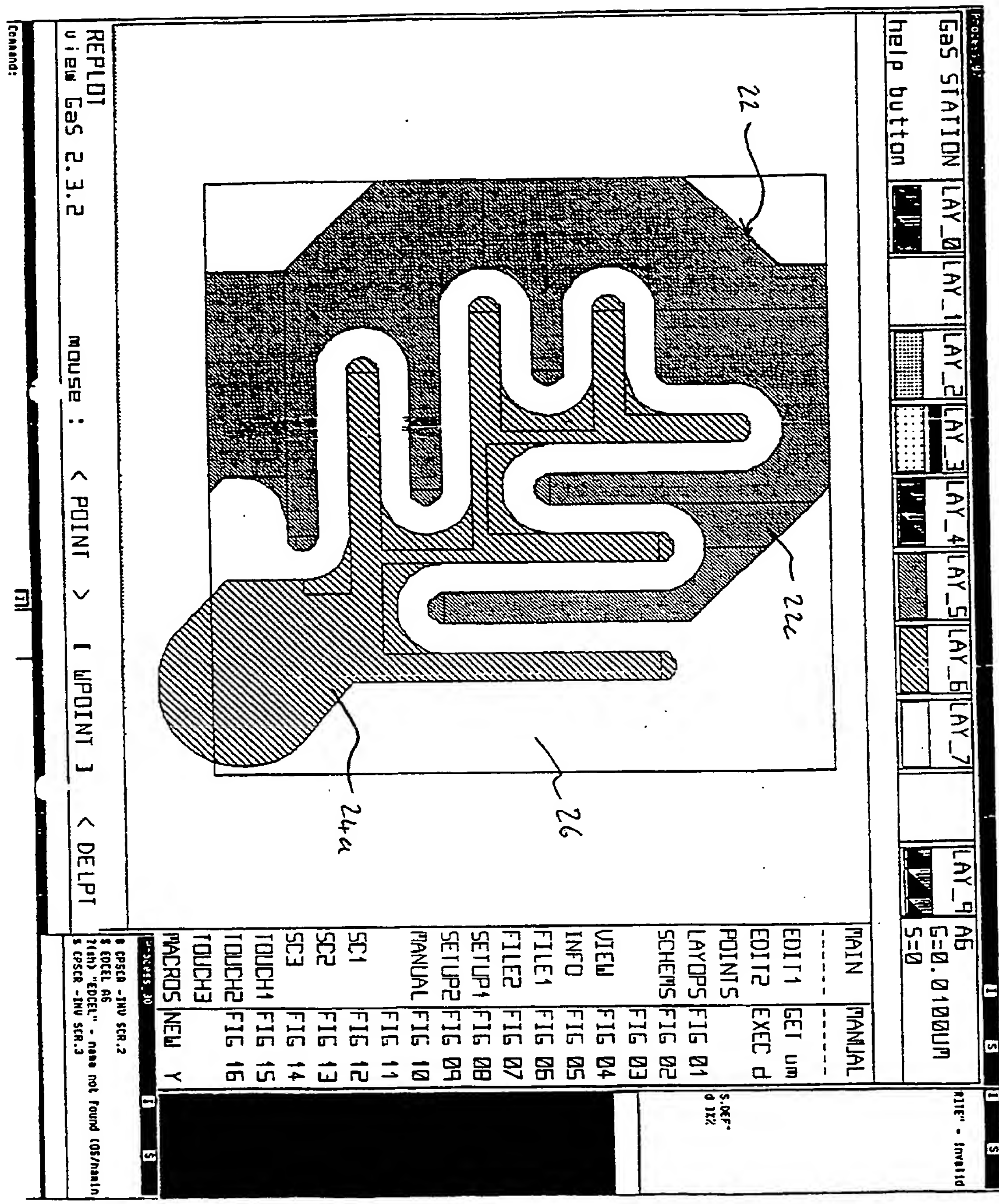

COLUMN ELECTRODE
ROW ELECTRODE
THIN FILM RESISTOR
16
22
22b
30
28
20
CONTACT PADS
100 uM
POLYIMIDE VIA
POLYIMIDE VIA
14
24
12
10

Fig. ~~26~~ 15

IGNORE DIFFERENT SHADINGS.



Drawing 1

Fig 16

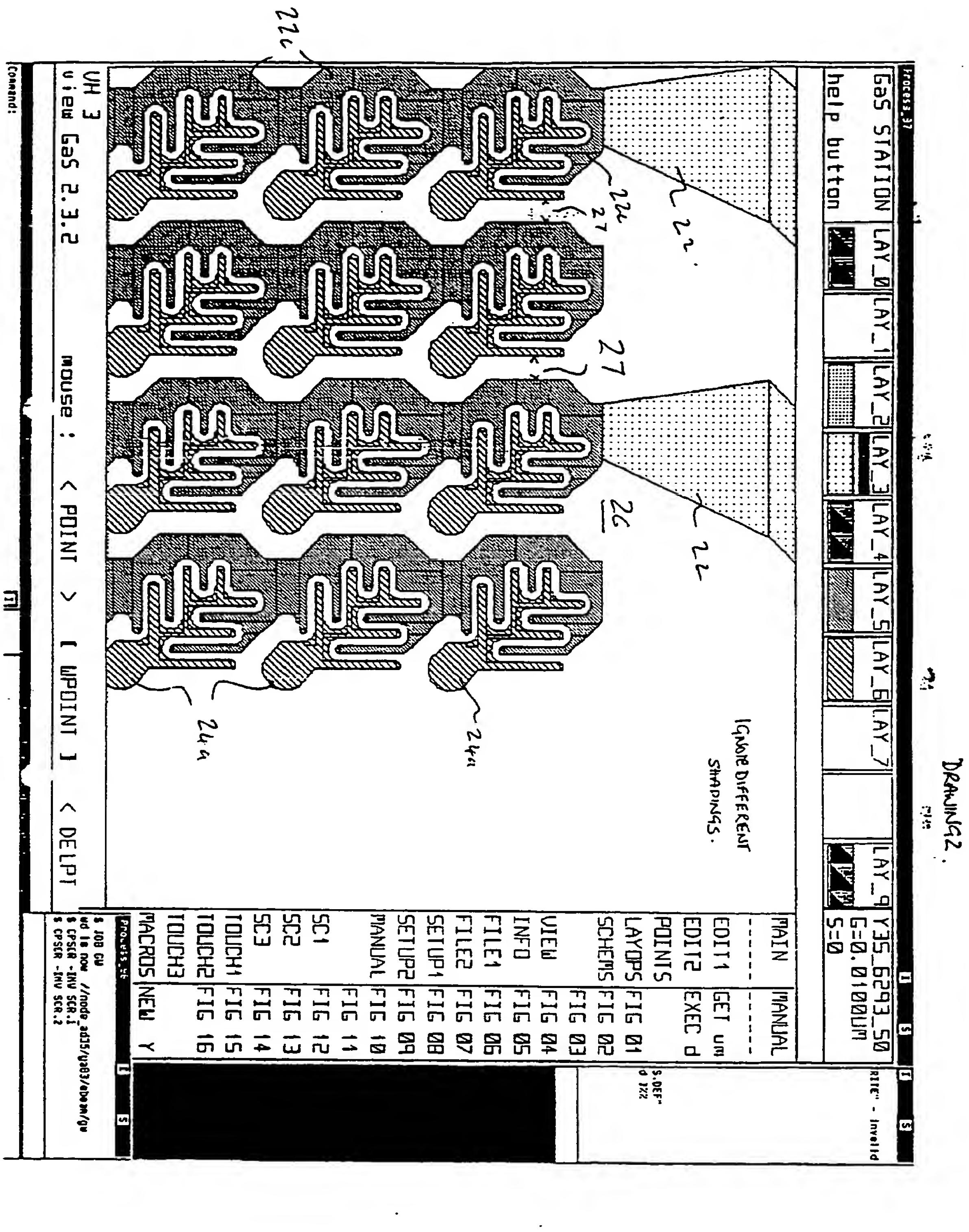
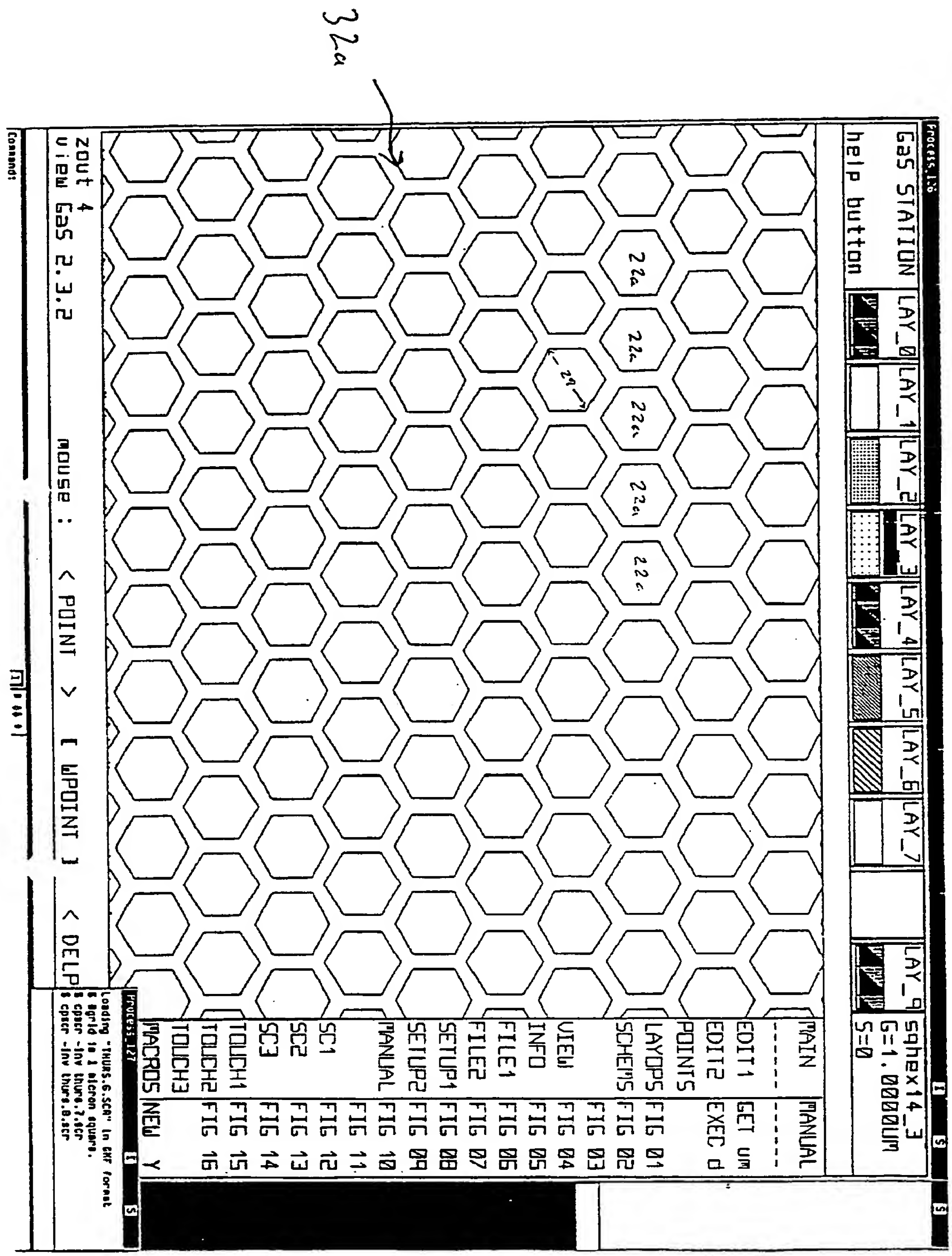

DRAWING2.
GaS STATION
help button
LAY_0
LAY_1
LAY_2
LAY_3
LAY_4
LAY_5
LAY_6
LAY_7
LAY_9
Y35_6293_50
G=0.0100UM
S=0
MAIN MANUAL
EDIT1 GET um
EDIT2 EXEC d
POINTS
LAYOPS FIG 01
SCHEMS FIG 02
FIG 03
VIEW FIG 04
INFO FIG 05
FILE1 FIG 06
FILE2 FIG 07
SETUP1 FIG 08
SETUP2 FIG 09
MANUAL FIG 10
FIG 11
SC1 FIG 12
SC2 FIG 13
SC3 FIG 14
TOUCH1 FIG 15
TOUCH2 FIG 16
TOUCH3
MACROS NEW Y
UH 3
view GaS 2.3.2
mouse : < POINT > [WPOINT] < DELPT
IGNORE DIFFERENT SHADINGS.
22c
22
27
26
24a

FIG 17



Drawing 9

FIG 18

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Office ur péen des brevets

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(54) **Digitizers.**

(57) A digitizer of high resolution and capable of discerning a pattern of applied low differential pressure is described. The digitizer comprises a matrix of cells each having a switch means connecting contact pad (24) and contact pad (22b) including a resistive means, and means for determining the pattern of a plurality of simultaneously applied pressures.

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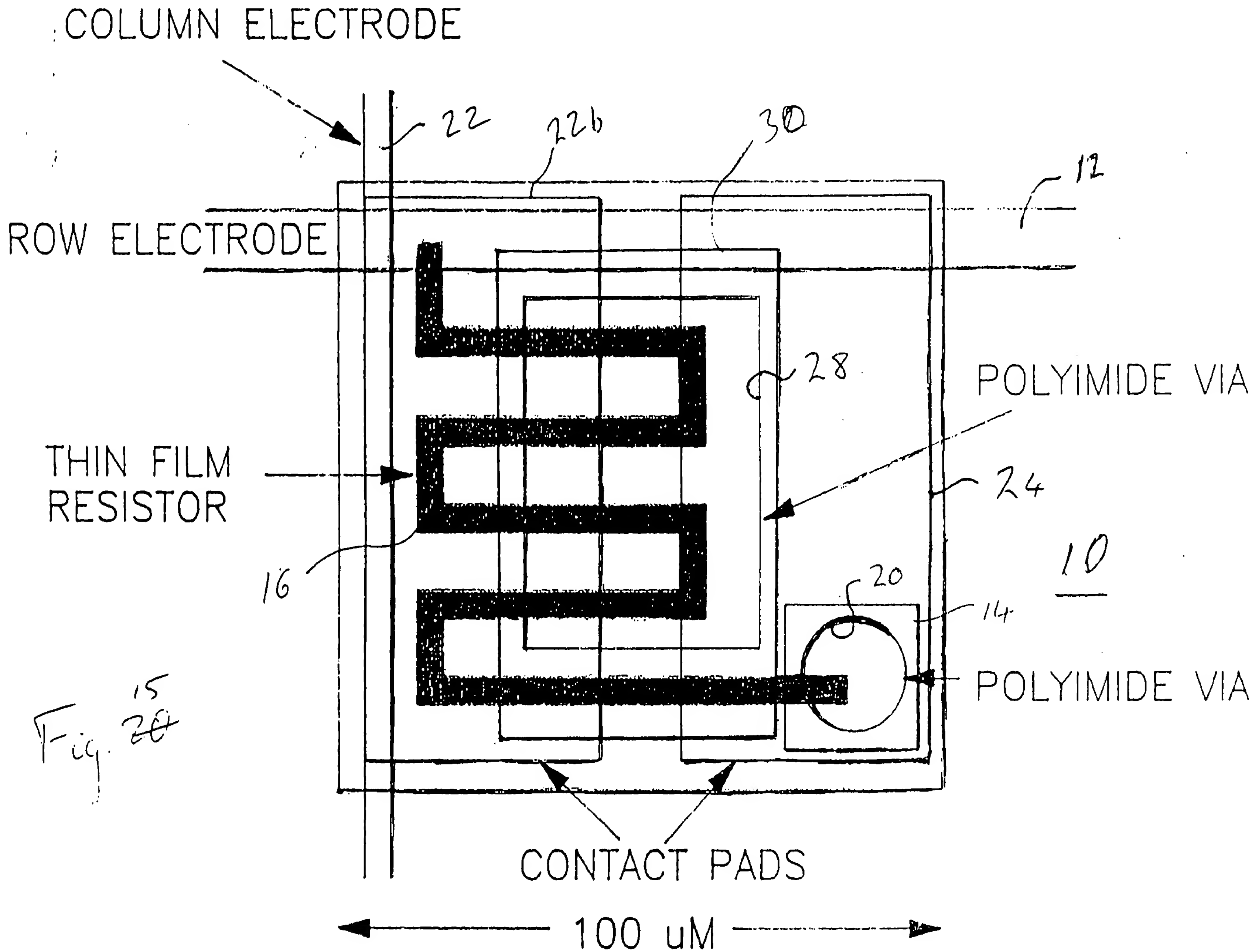
COLUMN ELECTRODE
22
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28
POLYIMIDE VIA
THIN FILM
RESISTOR
24
10
16
20
14
POLYIMIDE VIA
CONTACT PADS
100 uM

Fig. ~~20~~ 15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 4906

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 5)
A	WO-A-8 701 574 (ISTITUTO SUPERIORE DI SANITA) * figure 2 *	1,8	G 06 K 11/12
A	US-A-4 207 444 (V.B. KLEY) * claim 1; figures 2,3 *	1,8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			G 06 K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	06-11-1991	ZOPF K

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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